Graduate School of Economics, Osaka University of Economics
Working Paper Series

No.2021-02

Note on the Fluctuation of Price and the Amount of Production at Japan's Ruling Period in Taiwan

大阪経済大学大学院 経済学研究科 博士後期課程
陳　玉芬

2022 年 4 月

Note on the Fluctuation of Price and the Amount of Production at Japan's Ruling Period in Taiwan[1]

Yu Fen Chen[2]

Abstract

This study aims to clarify the factors contributing to changes in price and production in Taiwan during Japan's ruling period. Chen (2021.a) noted that Japan's wholesale price was the main factor explaining the change in Taiwan's wholesale price. We estimated the vector error correction model with real gross domestic product (GDP), GDP deflator, and Japan's GDP deflator from 1907 to 1940. The results of the analysis of the forecast vector error correction (VEC) model showed that the Japanese price shock ratio to the fluctuation of the Japan's GDP deflator was 88.17%. Taiwan's production shock accounted for 86.00% of Taiwan's real GDP fluctuations. Japan's price shock accounted for 81.40% of Taiwan's GDP deflator fluctuations. Thus, the fluctuations in Taiwan's GDP deflator during Japan's ruling period are explained mainly by the price shock in Japan. The results of Chen (2021.a) are reinforced by this result.

Keywords: price fluctuation, Taiwan, Japan's ruling period, VEC Model

JEL Classification: E51, O53

[1] This paper is based on Chen (2021.b, Chapter 6).
The author is grateful to Professor Makoto Kurosaka, Professor Wataru Takahashi, Professor Yukio Fukumoto, and Associate Professor Yoshiko Hayashi. The remaining errors are mine.

[2] Graduate School of Osaka University of Economics, E-mail: g199201@osaka-ue.ac.jp

I. Introduction

This study aims to clarify the factors that contributed to changes of price and production in Taiwan during Japan's ruling period. Chen (2021.a) noted that Japan's wholesale price was the main factor explaining the change in Taiwan's wholesale price. Section II explains Taiwan's macroeconomy during Japan's ruling period and the Kuomingtang ruling period by organizing descriptive statistics of the basic macroeconomic variables. Section III summarizes previous studies on Taiwan's economic development and the theory of price flexibility. Section IV presents some tests of macroeconomic time-series data to perform a time series analysis. Section V presents the vector error correction (VEC) model and innovation accounting. Finally, Section VI concludes the study.

II. Taiwan's Economy at the Time of Japan's Ruling Period

(II-1) Descriptive Statistics of Basic Macroeconomic Variables in Japan's Ruling Period and the Kuomingtang Ruling Period

Taiwan was under Japanese rule from 1895 to 1945. Subsequently, Kuomingtang governed Taiwan until 1991. We obtained descriptive statistics of basic macroeconomic variables using Mizoguchi et al. (2008). The results are illustrated in Tables 1.1, 1.2, and 1.3.

Table 1.1 Descriptive Statistics of Basic Macroeconomic Variables During Japan's Ruling Period

1903–1943 (years)	Mean (%)	Standard Deviation (%)	Coefficient of Variation	Maximum Value (%)	Minimum Value (%)
Real Domestic Product	2.66	6.28	2.37	12.76 (1917)	-18.67(1905)
Real Private Consumption	1.85	6.05	3.28	14.51(1913)	-16.83(1905)
Real Government Final Consumption Expenditure	4.31	14.02	3.25	53.60(1910)	-37.47(1912)
Real Gross Capital Formation	7.25	24.37	3.36	82.11(1917)	-22.76(1924)
Nominal GDE	6.86	10.63	1.55	28.34(1919)	-18.34(1921)

Consumer Price Indexes	5.17	12.09	2.34	30.33(1942)	-23.84(1931)
GDP Deflator	4.32	10.28	2.38	25.64(1918)	-20.36(1921)
Wholesale Price Index (1907–43)	4.64	13.52	2.91	52.52(1943)	-21.67(1921)
Real GDP of Primary industry (1905–43)	2.95	7.66	2.60	22.29 (1913)	-14.03(1912)
Real GDP of Secondary industry (1905–43)	5.95	10.53	1.77	36.78 (1909)	-15.47 (1911)
Real GDP of Tertiary industry (1905–43)	2.81	7.88	2.81	20.43 (1905)	-17.69 (1943)
M1	12.65	12.07	0.95	33.96(1917)	-9.61(1930)
Male-Nominal Manufacturing Wage Indexes (1903-40)	2.75	10.74	3.90	43.62(1920)	-19.55(1929)
Female-Nominal Manufacturing Wage Indexes (1904-40)	4.97	12.90	2.60	37.47(1904)	-15.03(1931)
Male-Real Manufacturing Wage Indexes (1903-40)	-0.91	13.39	-14.65	43.45(1921)	-25.13(1917)

GDP: gross domestic product, GDE: gross domestic expenditure

Table 1.2 Descriptive Statistics of Basic Macroeconomic Variables During the Kuomingtang Ruling Period

1953–1991 (years)	Mean (%)	Standard Deviation (%)	Coefficient of Variation	Maximum Value (%)	Minimum Value (%)
Real GDP	8.71	2.75	0.32	12.98 (1976)	1.15 (1974)
Real Private Consumption	7.73	2.85	0.37	13.39 (1989)	1.82 (1974)
Real Government Final Consumption Expenditure	6.65	4.78	0.72	16.57 (1975)	-11.41 (1974)
Real Gross Capital Formation	10.97	8.53	0.78	23.08 (1965)	-15.26 (1955)
Nominal GDE	15.06	5.07	0.34	29.20 (1974)	5.43 (1985)
Consumer Prices Indexes	6.03	7.05	1.17	38.88 (1974)	-0.19 (1964)

GDP Deflator	5.84	5.27	0.90	28.07 (1974)	-0.64 (1965)
Wholesale Prices Index	4.52	7.78	1.72	34.06 (1974)	-5.20 (1975)
Real GDP of Primary Industry	3.28	4.10	1.25	13.66 (1961)	-5.19 (1954)
Real GDP of Secondary Industry	11.38	5.45	0.48	20.73 (1954)	-0.62 (1974)
Real GDP of Tertiary Industry	9.22	3.35	0.36	14.87 (1989)	0.81 (1961)
M1	20.58	10.12	0.49	41.49 (1986)	-6.88 (1990)
Male-Nominal Manufacturing Wage Indexes	11.94	6.39	0.53	29.02 (1974)	-4.14 (1973)
Female-Nominal Manufacturing Wage Indexes	11.03	7.18	0.65	28.37 (1974)	-12.56 (1962)
Male-Real Manufacturing Wage Indexes	5.58	5.68	1.02	14.12 (1971)	-11.98 (1973)

GDP: gross domestic product, GDE: gross domestic expenditure

Table 1.3 Japan's Descriptive Statistics of Basic Macroeconomic Variables (1907–1938)[3]

1907–1938 (years)	Mean (%)	Standard Deviation (%)	Coefficient of Variation	Maximum Value (%)	Minimum Value (%)
GDP	3.36	5.04	1.50	14.29(1916)	-7.46(1930)
Consumer Prices Indexes (Including rent)	2.18	9.57	4.38	29.72(1918)	-12.25(1931)
GDP Deflator	2.12	12.42	5.86	27.01(1918)	-28.52(1930)
Wholesale Prices index	2.42	11.79	4.87	27.02(1918)	-25.83(1921)
Manufacturing Real Wage Index	2.31	6.28	2.72	23.49(1920)	-7.22(1911)

GDP: gross domestic product

Note that the average growth rate of the real GDP of the secondary industry is 5.59% during this period. From Tables 1 and 2, we find that the coefficient of variation of male real wage in the manufacturing industry in Japan's ruling period is much larger than that of the Kuomingtang ruling period. The mean rate of change of male real wages in the manufacturing industry at Japan's ruling period is -0.91%. During Japan's ruling period,

[3] We obtained Japan's descriptive statistics of basic macroeconomic variables using Ohkawa (1967,1.2).

there seems to have been a tendency for male real wages in the manufacturing industry to return to the original level after fluctuation. Thus, we can interpret that Taiwan's economy in this period is akin to Lewis's model of the unlimited labor supply. In Taiwan, during Japan's ruling period, the coefficient of variation of real gross domestic product (GDP), real private consumption, real government final consumption expenditure, and real gross capital formation are larger than those of the Kuomingtang ruling period. Yoshikawa (1992) noted that one of the characteristics of Japan's economy before 1945 was the unstable fluctuation of private consumption compared to the movement of private consumption after World War II. Note that the coefficient of variation of real private consumption during Japan's ruling period is much larger than that in the Kuomingtang ruling period.

We confirm that almost the same is true for Taiwan. Value of natural logarithm of male and female real wages in the manufacturing industry are depicted in Figures 1 and 2.

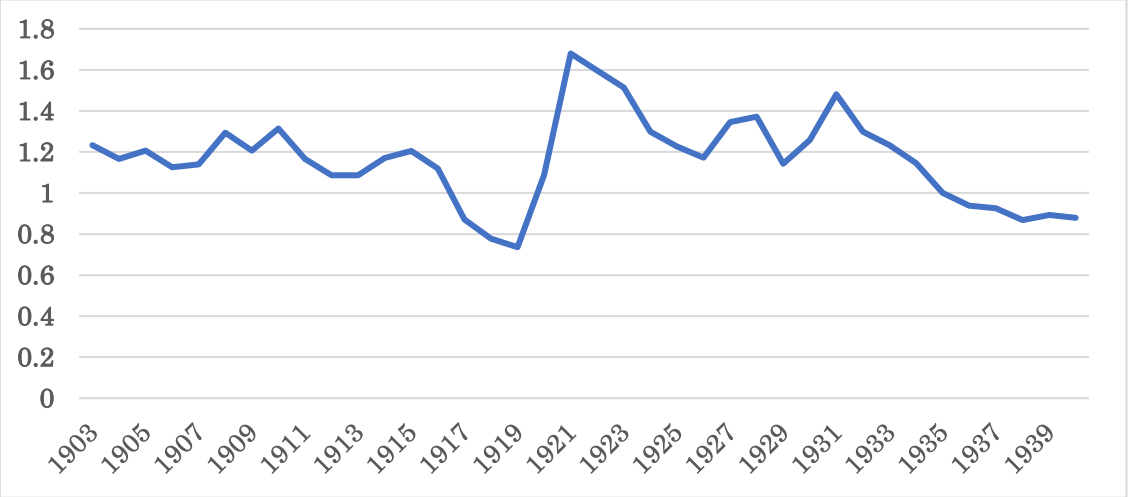

Figure 1. Value of natural logarithm of male real wages in the manufacturing industry

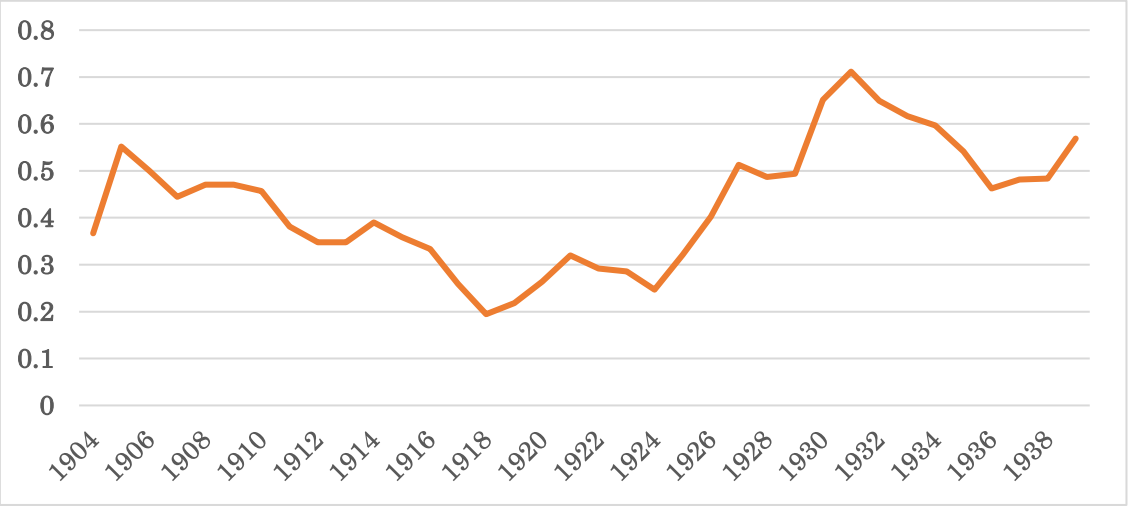

Figure 2. Value of natural logarithm of female real wages in the manufacturing industry

(II-2) Industrial Structure and the Degree of Dependence on Foreign Trade

(II-2-1) Japan's Ruling Period

The nominal value ratio of each industry to the nominal GDP is depicted in Figure 3. The nominal value ratio of production of the primary industry in Japan's ruling period is approximately 0.4–0.5, and that of the tertiary industry is almost the same. Note that the nominal value ratio of production of the secondary industry to the nominal GDP increased successively during Japan's Ruling period. The degree of dependence on foreign trade is derived, as shown in Figure 4. We derive the degree of dependence on foreign trade as the ratio of nominal value of export plus import to nominal GDP. For comparison, we interpret the trade between Japan and Taiwan as foreign trade in Japan's ruling period. The degree of dependence on foreign trade has an increasing tendency until 1939. It was 0.67 in 1939.

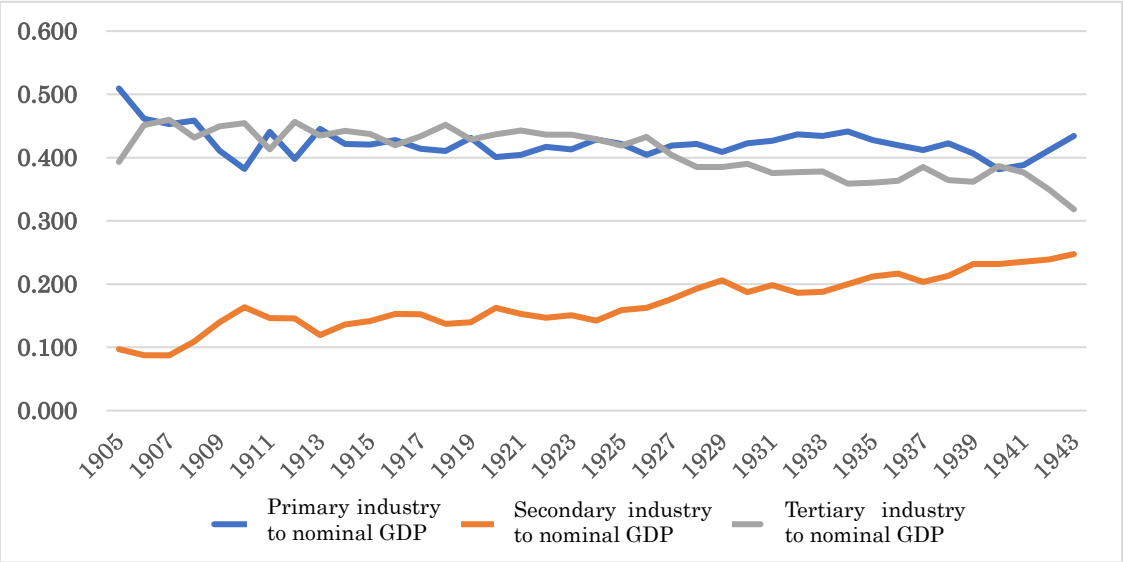

Figure 3. Ratio of the nominal value of each industry (Japan's Ruling Period)

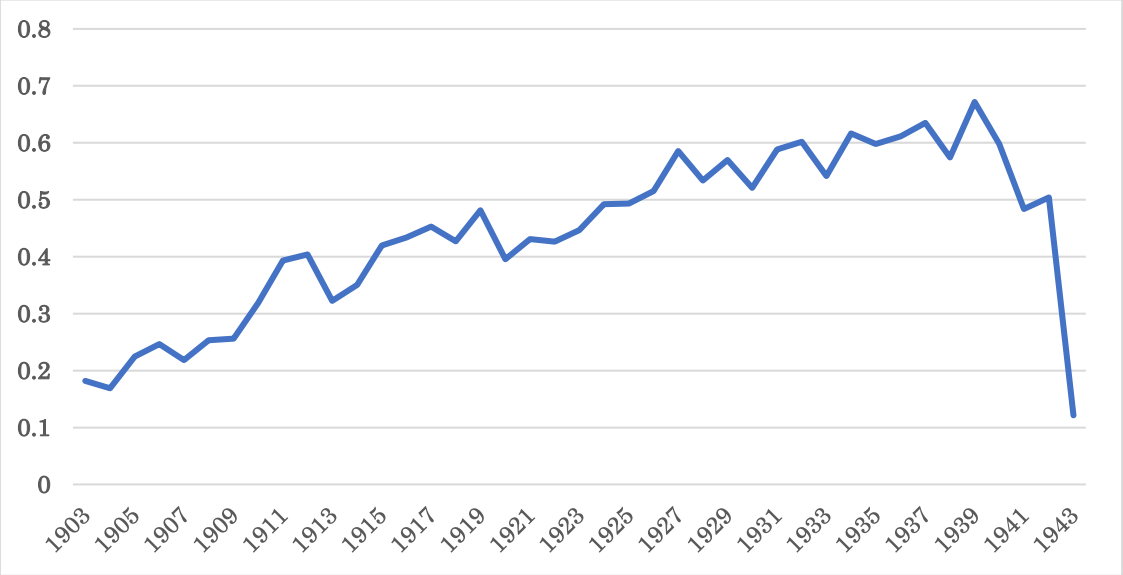

Figure 4. Degree of dependence upon foreign trade (Japan's Ruling Period)

(II-2-2) Kuomingtang Ruling Period

Figures 5 and 6 depict the industrial structure and degree of dependence on foreign trade during this period, respectively. We used data from Mizoguchi (2008). The nominal value ratio of the secondary industry to the nominal GDP increased significantly. Considering the high economic growth rate during this period, we can guess that the manufacturing and construction industries grew significantly. The degree of dependence on foreign trade surpassed one at 1986. It is evident that Taiwan's economy crucially depends on foreign trade.

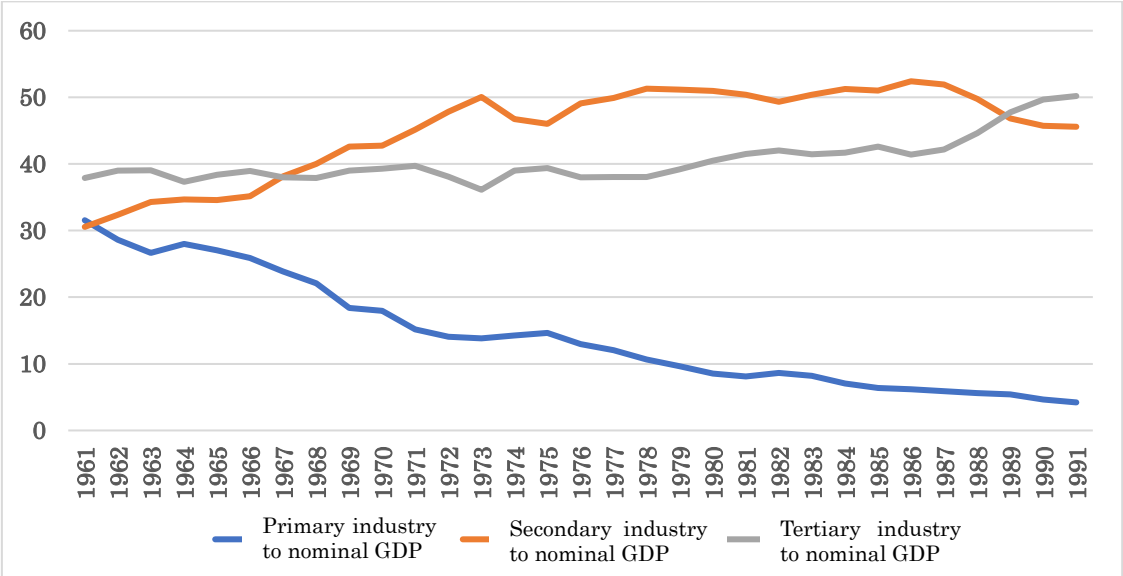

Figure 5. The nominal value ratio of each industry (Kuomingtang ruling period)

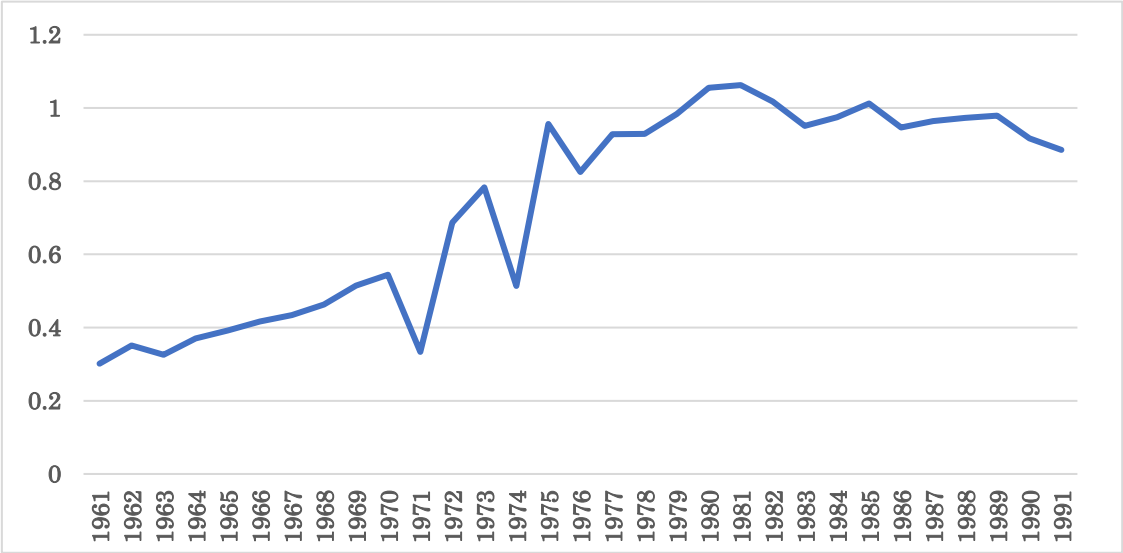

Figure 6. The degree of dependence upon foreign trade (Kuomingtang ruling period)

III. Previous Studies

(III-1) Previous Studies on Taiwan's Economic Development From Japan's Ruling Period to the Kuomingtang Ruling Period

Taiwan's economic development during Japan's ruling period was noted by Tou (1992) and Yeh (2009). According to Tou (1992), European merchant companies called

Yang Hang came to Taiwan to gather and export sugar camphor and tea (Sumiya, Liou, & Tou, 1992). Tou (1992) noted that before Japan's ruling period in Taiwan, sugar camphor and tea industries had developed. Landowner peasants and indigenous merchants governed the predation process for these products and European companies' process of transportation, trade, and finance. According to Tou (1975, Chapter 2), Taiwan's colonization process can be classified into four periods. The first period was from 1895 to 1905, when colonization by Japan began. The second period was from 1905 to the 1920s, when the modern sugar manufacturing industry was developed. At that time, Taiwan had become a monoculture economy composed of sugar and sugarcane production. The third period is from the mid-1920s to the latter part of the 1930s. In the fourth period from the latter part of 1930s to 1945, which is when World War II ended, the production of penglai rice and sugarcane was developed. This period was characterized by military industrialization. According to Yeh (2009), under Japan's rule, Taiwan is characterized as a period of modernization and Japaneseization. Modernization signifies that the basic structure of the modern economy was constructed at this time. Japaneseization signifies that the mutual economic relationship between Taiwan and Japan had deepened. The average growth rate of per capita GDP for peasant families was 1.53% in this period. Economic growth induced an increase in consumption and reduced the savings rate. People's living standards increased. penglai rice and sugar were the primary exports to Japan. The fluctuation in Taiwan's prices was almost the same as that in Japan's. We note that Tou (1975) (1992) and Yeh (2009) state that the basic structure of capitalism was constructed, production of penglai rice and sugar was developed, and economic growth was realized. As for previous studies on Taiwan's ruling period, we summarize some important studies from the standpoint of our study.

Taiwan's economy became highly developed, making it one of the developing countries during this period. Many developing economies note that Taiwan's economy passed the changing point that Lewis (1954) depicted. Asamoto (1996, Chapter 6) noted that the subsistence wage theory of classical schools could be applied in Taiwan until the former part of the 1960s. He noted that the theory of marginal product by the new classical school could be applied. Fei and Ranis (1975) stated that the stage when the real wage was smaller than the marginal product of labor because of the unlimited supply of labor ended in 1965–1966. Sumiya (1992, Chapter 1) noted that millions of excess laborers existed in Taiwan in the 1950s. Excess labor supply from rural areas was the main incentive for foreign companies to invest in the 1960s. Taiwan's labor market began to change because excess labor from rural areas almost vanished in 1968.

According to Ho (1972), Taiwan's growth experience regarding labor reallocation in the relevant period indicates that the role of labor transfer in the development of an economy with a surplus population may have been overstressed. In summary, we consider that the turning point of the Lewis model ended during the Kuomingtang ruling period.

Wu and Gau (1991) performed a Granger causality test between money supply and the wholesale price index using annual and monthly data from 1907 to 1956. Wu and Gau (1991) concluded that the growth rate of money supply being Granger causal causes inflation rate at 5 percent significance level.

(III-2) Previous Studies on the Economic Theory of Price Flexibility

In this section, we discuss previous studies on price flexibility. Theoretically, we can consider the relationship between fluctuations in wages, prices, production, and economic growth as follows: If price and wage are sufficiently flexible, the disequilibrium between supply and demand can soon be equalized. Production fluctuation is small, and full labor employment can be attained. However, we can assume another mechanism that makes an economy unstable. The equilibrium price depends on how economic agents expect future prices. In this case, the price level could become too high, leading to accelerated inflation. According to Tobin (1993), the rigidity of price and wage is not indispensable for Keynesian. De Long and Summers (1986) showed that increased wage and price flexibility could be stabilizing because the expectation of falling prices decreases output. While lower prices increase output, the expectation of falling prices decreases it. We consider that a significant value of the standard deviation of the price change rate indicates the flexibility of the price mechanism. A small value of the standard deviation of real economic variables means the stability of the economy; according to Yoshikawa (1988), the coefficient of variation of nominal wage, nominal price, and real wage is greater in the pre-war days than the later days of World War II in three of four times. Yoshikawa (1988) found that the coefficients of variation of the production index in pre-war days are almost the same as those of late war days. Yoshikawa (1988) concluded that price flexibility does not necessarily guarantee economic stability. Yoshikawa and Sioji (1990) showed that the variation in nominal and real macroeconomic variables in pre-war days was larger than in late war days. Yoshikawa and Sioji (1990) noted that nominal wages on pre-war days were downward-rigid. Nishimura and Teruyama (1990) analyzed the real economic growth

rate and the gross national product (GNP) deflator of the United States and Japan in three periods (1888–1914, 1922–39, 1957–1987). In the U.S, the GNP deflator's standard deviation and the GNP's growth rate in 1929–1939 were bigger than those in 1888–1914.

Nishimura and Teruyama (1990, a. b.) maintained that we need to distinguish supply and demand shocks to analyze the relationship between price flexibility and economic stability. They showed that the real economic growth rate variation could be explained by long and supply shocks. Kitamura (2002) noted that deflation was commonplace in pre-war days, and downward rigidity of prices and wages was not observable in the 19th century. Mio (2001) explained how the AD-AS model could be applied to the structural VAR model (Vector Autoregression Model). Kama (1990) analyzed the structural VAR model using quarterly data of real GNP and the GNP deflator from the first quarter of 1958 to the last quarter of 1988. Kama (1990) analyzed the structural VAR model using quarterly data of real GNP and the GNP deflator from the first quarter of 1958 to the last quarter of 1988. Kama (1990) showed that the weight of the demand shock in inflation was approximately 30% using the method of variance decomposition of the forecast. Kama (1990) noted that inflation was mainly derived from supply shocks during this period. Chang (2003) estimated a structural VAR model using the monthly data of the Chinese GDP deflator and the price index of manufacturing production from January 1983 to December 2001. Chang (2003) showed that variations in real production in China were mainly derived from supply shocks, and prices in China were mainly derived from demand shocks. Tokuda (2007) estimated the VAR model using quarterly data on the price index of banks' equity, real GDP, call rate, and base money from the first quarter of 1983 to the second quarter of 2006. Tokuda (2007) analyzed the effectiveness of the monetary policy. Naito (2017) analyzed the effectiveness of the monetary policy by using monthly data on the monetary base, call rate, consumer price index, and indices of industrial production, and estimated the structural VAR model. Fukumoto (2006) estimated a structural VAR model using quarterly data on the consumer price index and indices of industrial production from January 1980 to December 1998 in the United States, Canada, Germany, France, and Britain. Fukumoto (2006) noted that currency unions in North America might be possible.

IV. Unit Root and Cointegration Test

Tables 4, 5, and 6 illustrate the results of the unit root tests and cointegration tests of real GDP (rgdp), the GDP deflator (tdef), and Japan's deflator (jdef)[4]. We use the SBIC (Schwarz Bayesian Information Criterion) criterion in the Augmented Dickey Fuller (ADF) test, and Newey-West estimates in the Phillips-Perron (PP) test for the lag degree.

Table 4. Unit Root Test Result (1907–1940)

Augmented Dickey Fuller test					
Variable	Only Constant Term (t-value)	Lag	Constant Term of Trend (t-value)	Lag	Decision
1907–1940					
Jdef (In levels)	-1.82	1	-2.21	1	I(1)
Δjdef (In first differences)	-3.03**	0	-2.98	0	
tdef (In levels)	-2.24	1	-2.96	1	I(1)
Δtdef (In first differences)	-4.15***	1	-4.11**	1	
rgdp (In levels)	-1.03	0	-2.42	0	I(1)
Δrgdp (In first differences)	-5.15***	0	-5.13***	0	

Symbols ***, **, * means that the null hypothesis is rejected at ***(1%), **(5%), and *(10%) levels, respectively. The lag degree in the ADF test is determined using the SBIC criterion. The bandwidth of the PP test is determined by Newey-West estimates.

Table 5. Unit Root Test Result (1907–1940)

Phillips-Perron test					
Variable	Only Constant Term (t-value)	Lag	Constant Term of Trend (t-value)	Lag	Decision
1907–1940					
Jdef (In levels)	-1.22	2	-1.56	2	I(1)
Δjdef (In first differences)	-2.83*	8	-2.80	8	
tdef (In levels)	-1.36	4	-1.86	3	I(1)
Δtdef (In first differences)	-2.80*	15	-2.72	15	
rgdp (In levels)	-1.14	5	-2.46	3	I(1)

[4] Data of Japan are obtained from Ohkawa (1967). Data of Taiwan are obtained from Mizoguchi (2008).

Δrgdp (In first differences)	-5.18**	7	-5.14***	6	

Symbols ***, **, * means that the null hypothesis is rejected at ***(1%), **(5%), and *(10%) levels, respectively. The lag degree in the ADF test is determined using the SBIC criterion. The bandwidth of the PP test is determined by Newey-West estimates.

We denote I (1) if the variable becomes stationary when taking the process of ordering one. The real GDP (rgdp), GDP deflator (tdef), and Japan's deflator can be judged from the results of Test I (1). We judged the real GDP (rgdp), GDP deflator (tdef), and Japan's GDP deflator (jdef) as I (1) variables. Table 6 presents the results of the cointegration tests of real GDP (rgdp), the GDP deflator (tdef), and Japan's deflator.

Table 6. Cointegration Tests Result from 1907 to 1940 in Japan's Ruling Period

1907–1940 (Order of lag is 1, (Judged by SBIC criterion))		
H_0: Null Hypothesis	Trace Statistic	Max-Eigen Statistic
The number of cointegration vectors is 0	51.24(35.19) *	34.97(22.30)*
p value	0.00	0.00
H_0: Null Hypothesis	Trace Statistic	Max-Eigen Statistic
The number of cointegration vectors is 0 or 1	16.27(20.26)	11.56(15.90)
p value	0.16	0.21
H_0: Null Hypothesis	Trace Statistic	Max-Eigen Statistic
The number of cointegration vectors is 1 or 2	4.71(9.16)	4.71(9.16)
p value	0.32	0.32

We performed this test assuming that the data level had no deterministic trends and that the cointegrating equations had intercepts. The null hypothesis, which means "cointegration vector is 0," is rejected at the 5% significance level. The null hypothesis, which means "cointegration vector is 0 or 1," is not rejected. Thus, we conclude that 1 cointegration vector exists. Table 7 presents the results of the information criterion for the orders of lag.

Table 7. Information Criterion on Orders of Lag 1907–1940

Lag	AIC	SBIC
6	-9.17*	-6.45
5	-7.67	-5.38
4	-7.13	-5.86
3	-7.51	-6.08
2	-7.85	-6.85
1	-7.45	-6.88*

V. VEC Model and Innovation Accounting

The estimators of the VEC model are shown in (1), (2), and (3). *t*-values are shown in parentheses. R^2 is the coefficient of determination. Table 8 presents the results of variance decomposition of the forecast error.

$$\begin{gathered}\Delta \mathrm{jdef}_t = 0.459\Delta \mathrm{jdef}_{t-1} + 0.253\Delta \mathrm{rgdp}_{t-1} + 0.095\Delta \mathrm{tdef}_{t-1} \\ (1.651) \qquad (0.550) \qquad (0.304) \\ +0.061(\mathrm{jdef}_{t-1} + 0.250\mathrm{rgdp}_{t-1} - 1.529\mathrm{tdef}_{t-1} - 10.99) \\ (0.364) \\ R^2 = 0.202\end{gathered} \tag{1}$$

$$\begin{gathered}\Delta \mathrm{rgdp}_t = 0.012\Delta \mathrm{jdef}_{t-1} - 0.004\Delta \mathrm{rgdp}_{t-1} - 0.092\Delta \mathrm{tdef}_{t-1} \\ (0.085) \qquad (-0.018) \qquad (-0.588) \\ +0.187(\mathrm{jdef}_{t-1} + 0.250\mathrm{rgdp}_{t-1} - 1.529\mathrm{tdef}_{t-1} - 10.99) \\ (2.254) \\ R^2 = -0.202\end{gathered} \tag{2}$$

$$\begin{gathered}\Delta \mathrm{tdef}_t = 0.262\Delta \mathrm{jdef}_{t-1} - 0.207\Delta \mathrm{rgdp}_{t-1} + 0.235\Delta \mathrm{tdef}_{t-1} \\ (1.301) \qquad (-0.619) \qquad (1.033) \\ +0.355(\mathrm{jdef}_{t-1} + 0.250\mathrm{rgdp}_{t-1} - 1.529\mathrm{tdef}_{t-1} - 10.99) \\ (2.945) \\ R^2 = 0.425\end{gathered} \tag{3}$$

Table 8. Variance Decomposition of Forecast Error

Japan's Ruling Period 1907–1940	Δjdef			Δrgdp			Δtdef		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1 year	100	0	0	0.49	99.51	0.00	65.25	11.40	23.35
3 years	98.61	1.32	0.07	1.30	94.10	4.60	90.66	3.44	5.90
5 years	95.98	3.53	0.48	2.72	90.74	6.54	92.44	4.55	3.01
10 years	90.89	7.62	1.48	5.01	87.41	7.58	85.45	11.58	2.97
15 years	89.01	9.13	1.86	5.81	86.43	7.75	82.64	14.20	3.16
20 years	88.17	9.80	2.03	6.17	86.00	7.83	81.40	15.37	3.23
25 years	87.69	10.18	2.12	6.38	85.75	7.87	80.68	16.05	3.27
30 years	87.38	10.43	2.19	6.51	85.59	7.90	80.21	16.50	3.29
35 years	87.16	10.61	2.23	6.61	85.47	7.92	79.87	16.82	3.31
40 years	87.00	10.74	2.26	6.68	85.39	7.93	79.63	17.05	3.32
45 years	86.87	10.34	2.29	6.73	85.32	7.94	79.43	17.24	3.33
50 years	86.76	10.92	2.31	6.78	85.27	7.95	79.28	17.38	3.34

(1) Percentage of Japan's price shocks in Δjdef fluctuations (%)
(2) Percentage of Taiwan's production shocks in Δjdef fluctuations (%)
(3) Percentage of Taiwan's price shocks in Δjdef fluctuations (%)
(4) Percentage of Japan's price shocks in Δrgdp fluctuations (%)
(5) Percentage of Taiwan's production shocks in Δrgdp fluctuations (%)
(6) Percentage of Taiwan's price shocks in Δrgdp fluctuations (%)
(7) Percentage of Japan's price shocks with Δtdef fluctuations (%)
(8) Percentage of Taiwan's production shocks with Δtdef fluctuations (%)
(9) Percentage of Taiwan's price shocks in Δtdef fluctuations (%)

See the results of the variance decomposition of the forecast error after 20 years. Japan's price shocks account for 88.17% of the fluctuations in the Japanese GDP deflator. Taiwan's production shocks account for 9.80% of Japan's GDP deflator fluctuations. Taiwan's price shocks account for 2.03% of the fluctuations in the Japanese GDP deflator.

Japan's price shocks account for 6.17% of Taiwan's real GDP fluctuations. Taiwan's production shocks account for 86.00% of Taiwan's real GDP fluctuations. Taiwan's price

shocks account for 7.83% of Taiwan's real GDP fluctuations.

Japan's price shocks account for 81.40% of Taiwan's GDP deflator fluctuations. Taiwan's production shocks account for 15.37% of Taiwan's GDP deflator fluctuations. Taiwan's price shocks account for 3.23% of Taiwan's GDP deflator fluctuations. It is important to note that the fluctuations in Taiwan's GDP deflator are mainly explained by the price shock in Japan. Figures 7, 8, and 9 show the impulse response results.

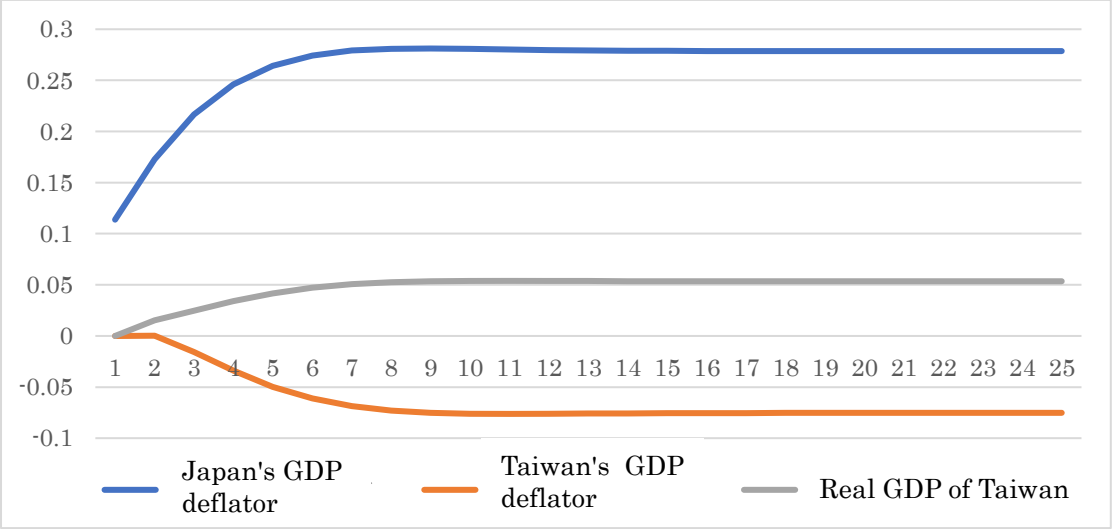

Figure 7. Response of Japan's GDP deflator to Japan's GDP deflator, Taiwan's GDP deflator, and Real GDP of Taiwan

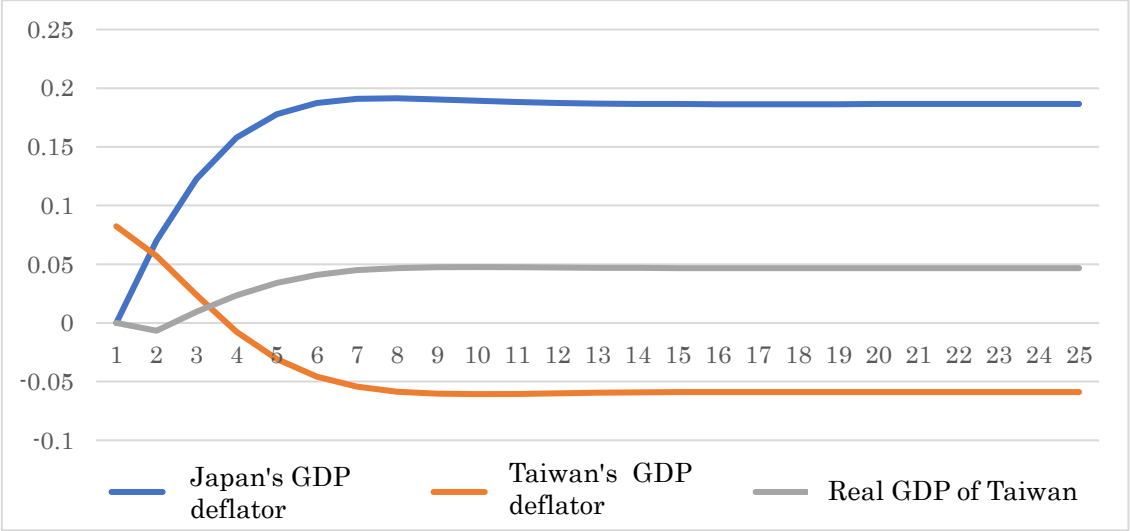

Figure 8. Response of Taiwan's GDP deflator to Japan's GDP deflator, Taiwan's GDP deflator, and Real GDP of Taiwan

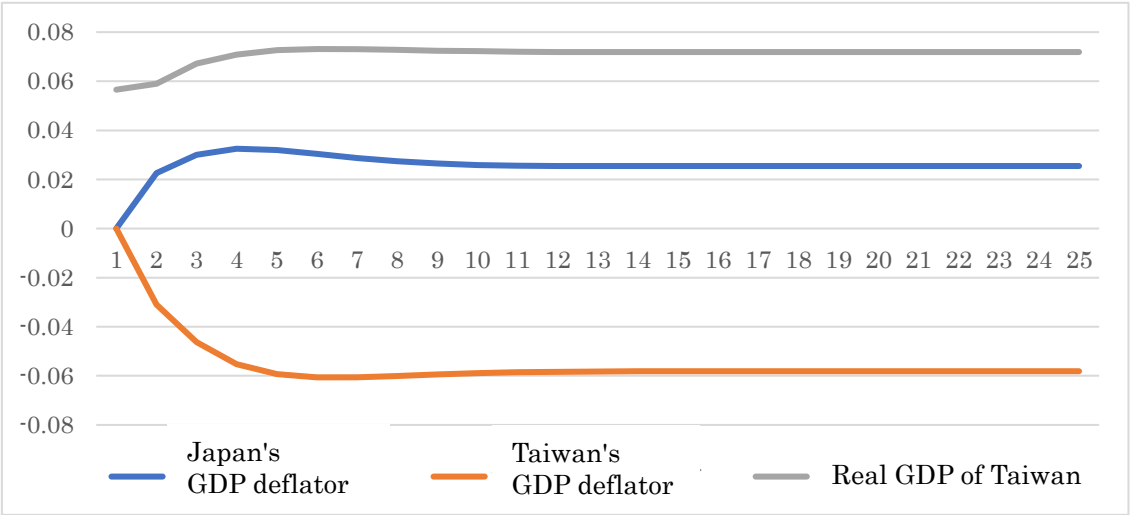

Figure 9. Response of Taiwan's real GDP to Japan's GDP deflator, Taiwan's GDP deflator, and Real GDP of Taiwan

Figures 7, 8, and 9 show that Japan's price shock positively impacted Japan's GDP deflator, Taiwan's GDP deflator, and Taiwan's real GDP. Taiwan's production shock also positively impacted Japan's GDP deflator, Taiwan's GDP deflator, and Taiwan's real GDP. Taiwan's price shock adversely impacted Japan's GDP deflator and real GDP. Taiwan's price shock will initially raise the Taiwan GDP deflator but will be adversely impacted four years later.

To confirm the robustness of this result, we estimated the VAR model of the level variable and obtained the variance decomposition of the forecast error and impulse response.[5] The same result was obtained, in that the production shock in Taiwan had a positive effect on the four variables. We obtained the same points between the results of the VEC model and those of the VAR model in levels.

(1) Taiwan's production shock positively affected Japan's GDP deflator, Taiwan's GDP deflator, and Taiwan's real GDP.
(2) Taiwan's price shock adversely affected Japan's GDP deflator and the real GDP.
(3) The Taiwan price shock initially positively affected the Taiwan GDP deflator, but it later had an adverse effect.
(4) Fluctuation of Taiwan's GDP deflator is mainly explained by the fluctuation of

[5] According to Kitaoka et al. (2013, p. 64), even if the variables of the VAR model include unit roots and there is a cointegration relationship between the variables, ordinary least squares regression is possible if the sample size is sufficient. Naito (2017) also estimated the VAR model in level and obtained variance decomposition of forecast error and impulse response function to confirm the robustness of this result.

Japan’s GDP deflator.

VI. Concluding Remarks

We analyzed the factors contributing to the change in the price and amount of production in Taiwan during Japan’s ruling period. Chen (2020) noted that Japan’s wholesale price was the main factor that explained Taiwan’s wholesale price change. We estimated the VEC model with real GDP, GDP deflator, and Japan's GDP deflator in Taiwan from 1907 to 1940. The main results are summarize follows:

(1) The coefficient of variation of male real wages in the manufacturing industry in Japan's ruling period is much larger than that in the Kuomingtang ruling period. The same is true for real private consumption expenditure.

(2) As for the result of the analysis of variance of the forecast error (20 years later), the ratio of Japan's price shock to the fluctuation of the Japanese GDP deflator was 88.17%. Taiwan's production shocks accounted for 86.00% of Taiwan's real GDP fluctuations. Japan's price shocks accounted for 81.40% of Taiwan's GDP deflator fluctuations. It is important to note that the fluctuations in Taiwan's GDP deflator are mainly explained by the price shock in Japan. The results of Chen (2020) were reinforced by this result.

(3) Japan's price shock positively impacted Japan's GDP deflator, Taiwan's GDP deflator, and Taiwan's real GDP. Taiwan's production shock also positively impacted Japan's GDP deflator, Taiwan's GDP deflator, and Taiwan's real GDP. Taiwan's price shock adversely impact Japan's GDP deflator and real GDP. Taiwan's price shock will initially raise the Taiwan GDP deflator but will impact it adversely four years later. To confirm the robustness of this result, we estimated the VAR model of the level variable and obtained similar results.

We maintain that analyzing economy of Japan's ruling period from an economic standpoint is important. This period may have been the starting point for Taiwan's economic development.

References in English

De Long, J. B. and Summers, L.H. (1986) “Is Increased Price Flexibility Stabilizing?, ” *The American Economic Review*, Vol.76, No.5, pp.1031-1044.

Fei, J.C.H. and Ranis, G. (1975) “A Model of Growth and Employment in the Open Dualistic Economy: The Cases of Korea and Taiwan,” *Journal of Development Studies*, Vol.11, No.2, Jan, pp.32-63.

Ho, Y.M. (1972) “Development with Surplus Population. The Case of Taiwan: A Critique of the Classical Two-Sector Model, à la Lewis,” *Economic Development and Cultural Change*, Vol.20, No.2, Jan, pp.210-234.

Lewis, W.A. (1954) “Economic Development with Unlimited Supplies of Labour,” *The Manchester School*, Vol.22, pp.139-191.

Tobin, J. (1993) “Price Flexibility and Output Stability: An Old Keynesian View” *Journal of Economic Perspectives*, Vol.7, No.1, pp.45-65.

References in Japanese

Asamoto Teruo (1996), *Gendai Taiwan Keizai Bunseki,* Keisousyobou

Chang Yen (2003) “Kouzougata VAR Niyoru Chugoku no BukkaHendou Bunseki,” *Waseda Shyougaku*, Vol. 398, pp. 125-142

Chen Yufen (2021.a) “Nippon Touchiki Taiwan ni okeru Kakaku no Hendouyouin ni tuite,” Graduate School of Economics, Osaka University of Economics Working Paper Series working paper No.2021-01 (https://www.osaka-ue.ac.jp/file/general/29020)

Chen Yufen (2021.b) “Taiwan no Kakakuhendou to Keizaihatten,” (Doctoral dissertation of Osaka University of Economics)

Fukumoto Yukio (2006) “Hokubei Tsuuka Tougou no Jisugen Kanousei,” *Osaka Keidai Ronshyu*, Vol. 57, No. 2, pp.97-117

Kama Kunio (1990) “AD/AS ni Yoru Keiki Hendou no Bunseki,” *Kikan Souka Keizai Ronshyu,* Vol. XIX, No. 4, pp. 125-142

Kitamura Yukinobu (2002) “Bukka to Keiki Hendou ni Kansuru Rekishi Teki Kousatsu,” Kinyu Kenkyu, pp. 1-34, Nippon Ginkou Kinyu Kenkyujyo

Kitaoka Takayoshi and Takahashi Harutaka and Tamekawa Kenichi and Yano Junji (2013), *EViews de Manabu Jissyou Bunseki no Houhou*, Nihonhyouronsya

Kurosaka Makoto (2021) “Nihon Touchiki Chousen Hantou no Kakaku Hendou ni Tsuite.” *Osaka University of Economics Working Paper Series No. 2021-01*

Mio Hitoshi (2001) “Infureritsu no Youin Bunkai: Kouzougata VAR ni yoru Jyuyou・Kyoukyu Youin no Shikibetsu,” *Kinyuu Kenkyuu*, Vol. 57, No. 2, pp.97-117, Nippon Ginkou Kinyu Kenkyujyo (http://www.i-repository.net/il/meta_pub/G0000031Repository_80000020)

Mizoguchi, Toshiyuki (2008), *Ajia Choki Keizai, Toukei,* Vol. I：*Taiwan*, Touyou Keizai Shinpoushya

Naito Tomonori (2017) “Nichyuu Sensou Niokeru Kinyuu Seisaku no Kouka：VAR Moderu Niyoru Seisaku Kouka No Hakkyuu Nituiteno Jissyou Bunseki,” *Kansai Daigaku Keizai Ronsyuu*, Vol. 67, No. 2, pp.145-162

Nishimura Kiyohiko and Teruyama Hiroshi (1990a) “Kakaku no Shinsyukusei to Keizai no Anteisei: Nihon to Beikoku no 100 Nen no Rekishi no Oshieru Mono Kaishya Kagaku Kenkyu‐Tokyo Daigaku Syakai Kagaku Kenkyujyo Kiyou,” Vol. 42, No. 2, pp.175-211, Tokyo Daigaku Syakai Kagaku Kenkyujyo

Nishimura Kiyohiko and Teruyama Hiroshi (1990b) “Kakaku to Suuryou – Nihon to Beikoku no 100 Nen” (*Keizai Riron he no Rekishiteki Pasupekutibu* edited by Yoshikawa Hiroshi and Okazaki Tetsuji, Chapter 5, pp.121-149, Tokyo Daigaku Shyuupankai)

Ohkawa Kazushi (1967,1) *Kokumin Shotoku* (Choki Keizai Toukei 1), Touyou Keizai Shinpousya

Ohkawa Kazushi (1967,2) *Bukka* (Choki Keizai Toukei 8), Touyou Keizai Shinpousya

Sato Kazuo (1981) “Senkanki Nihon no Makuro Keizai to Mikuro Keizai” *SenKanki no Nippon Keizai Bunseki edted by* Nakamura Takafusa, pp.4-51, Yamakawa Shuppansha

Sumiya Mikio and Liou Jin Ching and Tou Zhaoyan (1992) *Taiwan no Keizai―Tenkei NIES no Hikari to Kage*, Tokyo Daigaku Syuppansya

Tokuda Masaaki (2007) “Kouzou VAR Moderu Niyoru Kinyuu Seisaku Kouka no Ichi Kousatsu,” *Shiga Daiaku Keizai Gakubu Kenkyuu Nennppo*, Vol. 14, pp. 103-119

Tou Zhaoyan (1975), Nihon Teikoku Shugika no Taiwan, Tokyo Daigaku Syuppankai

Yoshikawa Hiroshi (1988) “Makuro Keizai no Hendou Nituite” (*Gendai Keizaigaku Kenkyu Atarashii Chihei wo Motomete* edited by Onizuka Yusuke and Iwai Katsuhito, pp.136-155, Tokyo Daigaku Shyuupankai)

Yoshikawa Hiroshi and Etsuro Shioji (1990), Senzen Nihon Keizai no Makuro Bunseki (*Keizai Riron eno Rekishiteki Pasupekutibu* edited by Yoshikawa Hiroshi and Okazaki Tetsuji, Chapter 6, pp.153-180, Tokyo Daigaku Shyuupankai)

References in Traditional Chinese

Wu Tsong-Min (2006) “Tai Wan Jhan Hou De E Sing Wu Jia Pong Jhang (1945-1950),” *Guo Shih Guan Syueh Shu Ji Kan*, Vol.10, pp.129-159、Guo Shih Guan

Wu Tsong-Min and GauYin-Feng (1991) “Tai Wan Huo Bi Yu Wu Jia Chang Chi Guan Si Jhih Yan Jiou: 1907–1986,” pp.23-71, Guo Li Tai Wan Da Syueh Jing Ji Syueh Si

Yeh Shu-Jhen (2009) “Rih Jhih Shih Dai Tai Wan Jing Ji De Fa Jhan,” *Tai Wan Yin Hang Ji Kan*, Vol.60, No.4, pp.224-273, Tai Wan Yin Hang